इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 9937 (1981): Portable methanometer (Electrical type)
[CHD 8: Occupational Safety, Health and Chemical Hazards]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

IS : 9937 - 1981

(Reaffirmed 1997)

Indian Standard

SPECIFICATION FOR PORTABLE METHANOMETER (ELECTRICAL TYPE)

UDC 622·412·1 — 83

© *Copyright* 1982

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs **6·00** Gr [illegible]

January 1982

Indian Standard

SPECIFICATION FOR PORTABLE METHANOMETER (ELECTRICAL TYPE)

Industrial Safety Advisory Committee, ISAC

Chairman	*Representing*
SHRI A. K. CHAKRABARTY	Directorate General Factory Advice Service and Labour Institutes, Bombay
Members	
SHRI P. R. SURENDRANATHAN (*Alternate* to Shri A. K. Chakrabarty)	
SHRI CHARANJIT LAL	Chief Controllerate of Explosives, Nagpur
SHRI B. R. DAVE (*Alternate*)	
DR S. K. CHATTERJEE	Directorate General of Health Services, New Delhi
PROF B. B. CHATTERJEE (*Alternate*)	
SHRI N. CHAWLA	Sandoz (India) Ltd, Thane
SHRI A. K. DAS	Loss Prevention Association of India Ltd, Bombay
SHRI S. PURUSHOTHAMA (*Alternate*)	
SHRI D. M. DHAR	Standing Committee on Safety for the Steel Industry, Durgapur
SHRI A. K. DAS GUPTA (*Alternate*)	
DIRECTOR (COMMERCIAL)	Central Electricity Authority, New Delhi
DEPUTY DIRECTOR (COMMERCIAL) (*Alternate*)	
DIRECTOR GENERAL OF MINES SAFETY	Directorate General of Mines Safety, Dhanbad
DIRECTOR, MINES SAFETY EQUIPMENT (*Alternate*)	
SHRI S. G. DEY	Central Boilers Board, New Delhi
SHRI G. M. PRASAD (*Alternate*)	
SHRI DURGESH CHANDRA	Century Rayon, Bombay
SHRI JAYANT ADHIA (*Alternate*)	
SHRI K. H. GANDHI	Ministry of Defence (DGI)
SHRI SATPAL SINGH (*Alternate*)	
SHRI P. N. GHOSH	Institute of Fire Engineers India, New Delhi
SHRI K. C. GUPTA	National Safety Council, Bombay
SHRI N. RAGHAVAN (*Alternate*)	
SHRI S. K. JAGNANI	Indian Cotton Mills Federation, Bombay
SHRI R. P. JHA	Indian Jute Mills Association, Calcutta

(*Continued on page* 2)

© *Copyright* 1982

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(*Continued from page* 1)

Members	*Representing*
Shri J. D. Jijina	Indian Airlines Corporation, New Delhi
Shri M. N. Arora (*Alternate*)	
Shri M. Kant	Safety Appliances Manufacturers' Association, Bombay
Shri Kirit Maru (*Alternate*)	
Shri Karan Singh	Indian National Trade Union Congress, New Delhi
Shri A. R. Keshava Murthy	Ministry of Communications
Shri Y. V. R. Reddy (*Alternate*)	
Shri P. Krishnan Nair	The Fertilizers and Chemicals Travancore Ltd, Udyogmandal
Shri H. R. Laxminarayan	Ministry of Shipping and Transport
Shri A. B. Thakur (*Alternate*)	
Shri G. B. Menon	Standing Fire Advisory Committee, New Delhi
Shri B. K. Narayana Bhagwan	Hindustan Aeronautics Ltd, Bangalore
Shri S. Srinath (*Alternate*)	
Shri S. G. Ranade	Directorate General of Ordnance Factories, Calcutta
Shri S. R. C. Rao	Hindustan Steel Ltd, Ranchi
Shri R. N. Das (*Alternate*)	
Representative	Railway Board, Ministry of Railways
Shri Y. K. Sapru	The Safety First Association of India, Bombay
Shri A. A. Jasdenvala (*Alternate*)	
Shri I. C. Sarin	Employees State Insurance Corporation, New Delhi
Dr K. M. Saxena (*Alternate*)	
Shri P. Seshadri	Ministry of Petroleum & Chemicals
Shri Jagjit Singh (*Alternate* I)	
Shri P. C. Easaw (*Alternate* II)	
Dr B. Singh	Central Mining Research Station (CSIR), Dhanbad
Shri P. R. Roy (*Alternate*)	
Shri D. K. Sirkar	Indian Chemical Manufacturers' Association, Calcutta
Shri S. J. Sharma (*Alternate*)	
Shri S. Venkaswamy	Directorate General of Civil Aviation, New Delhi
Dr Hari Bhagwan, Director (Chem) (*Secretary*)	Director General, ISI (*Ex-officio Member*)

Safety Equipment Subcommittee, ISAC/S-2

Convener	
Shri D. M. Dhar	Durgapur Steel Plant, Durgapur
Members	
Shri J. J. Adhia	Century Rayon, Bombay
Shri M. V. Rao (*Alternate*)	
Shri K. Bardhan	Ministry of Defence (DGI)
Shri J. P. Agarwal (*Alternate*)	

(*Continued on page* 10)

Indian Standard

SPECIFICATION FOR PORTABLE METHANOMETER (ELECTRICAL TYPE)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 August 1981, after the draft finalized by the Industrial Safety Advisory Committee had been approved by the Executive Committee.

0.2 Portable methanometers operate on the principle of oxidation/ thermal conductivity of methane and are powered by dry cells or accumulators. They are used mostly in coal mines and in other underground installations, tunnels, shaft/deep well, etc, where it may be necessary to detect and/or measure methane concentration in methane-air mixture. The units should be durable and safe in service, suitable for conditions of underground use and functionally reliable. Further, great care should be taken in their design and construction, so that they offer no explosion hazard when used in gassy or dusty mine atmosphere. This standard is intended to assist the concerned authorities in testing portable methanometers in the light of requirements given in this specification.

0.3 While preparing this standard, the committee felt that portable methanometers should be checked and calibrated periodically. It is recommended that these instruments should be calibrated and inspected, preferably, at least once every three months.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and methods of test for portable methanometers operating on the principle of oxidation/thermal conductivityof methane.

---

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 **Aspirator** — It is the system which supplies the sample into the instrument for detection and/or measurement.

2.2 **Transducer** — It is the device which is incorporated into the instrument as a methane sensing element by conversion of physical and chemical properties of the gas to electrical parameters for subsequent measurement.

2.3 **Reaction Chamber** — Except for openings for inlet and outlet of the gas sample, it is an air-tight compartment in which the transducer is fitted.

2.4 **Diffusion Head** — It is the assembly which incorporates the transducer where during operation of the instrument the gas sample is continuously fed by thermal diffusion through permeable flame arresting covers such as a sintered disc and where no aspiration is necessary except in the case of remote sampling.

2.5 **Flame Arrestor** — It is a device to arrest the transmission of flame or sufficient heat energy from the diffusion/reaction chambers to the outside atmosphere, so that explosion hazard is eliminated.

2.6 **Meter** — It is the component for indicating methane concentration by volume, percent (*v/v*).

2.7 **Sampling Probe** — It is the device which allows the drawing of samples from remote places directly to the instrument for subsequent measurement.

2.8 **Type Tests** — Tests carried out to prove conformity with the requirements of a particular specification. These are intended to check the general performance and design of a given type of methanometer.

2.9 **Acceptance Tests** — Tests carried out on samples selected from a lot for acceptance of the lot.

2.10 **Routine Tests** — Tests carried out on every methanometer to check requirements which are likely to vary during production.

3. MATERIALS AND CONSTRUCTION

3.1 General

3.1.1 The methanometer shall be intrinsically safe. Its design shall be such that when all the parts have been properly assembled, the complete unit shall be dust-proof. It shall be so designed that drainage of power cannot take place through any external part of the instrument, in normal use, to such an extent as to cause danger in the mine. The mass of the complete unit with all accessories shall not exceed 1·5 kg.

3.1.2 The meter indication shall be independent of the angle of inclination of the instrument, when measurements are made subject to the limits of accuracy as per **5.1.**

3.1.3 The chargeable batteries shall be charged only above ground.

3.2 Enclosing Case

3.2.1 The enclosing case shall be of a material strong enough to withstand the drop test as per **6.3.1** and shall be reasonably antistatic.

3.2.2 The external components shall not be made of light metals like aluminium, magnesium or titanium and their alloys which are prone to give rise to incendive sparks.

3.3 Securing Device — In order to prevent unauthorised opening of the instrument, all covers shall be so secured that they cannot be dismantled without the help of special tools designed for the purpose.

3.4 Checking Device — A methanometer shall be so constructed as to provide access to all points for checking its operation as far as practicable. Provision shall be made to indicate the condition of the battery to know whether working voltage is available or replacement/recharging of the battery is necessary.

3.5 Contacts — Electrical contacts of micro-switches, battery chambers, etc, shall be of corrosion resisting material with excellent conducting properties.

3.6 Actuators — Provision shall be made, so that the switches are operated externally by means of appropriate actuators to minimize damage to the switches.

3.7 Sampling Devices — Provision shall be made for remote sampling probe (*see* **3.8**). The instrument may also have any of the following devices or their combinations with characteristics indicated against each.

3.7.1 *Aspirator Assembly* — The aspirator assembly shall be so designed as to ensure one-way feeding of sample atmosphere into the reaction chamber of the methanometer.

3.7.2 *Diffusion Device* — The diffusion device shall be so designed that the sensitivity of the methanometer remains practically independent of pressure change up to ±7·5 cm of Hg within the limits specified under **5.1.**

3.8 Remote Sampling Probe — It shall have adequate arrangements to connect it properly with the sampling line diffusion head of the instrument and shall be made of corrosion-resistant material. This shall be of a nature which, when fully extended, shall be not less than 1·2 metre in length and shall feed undiluted samples to the instrument.

3.9 Reaction Chamber — The sampling duct of the reaction chamber shall be plugged with a cylindrical stainless steel wire gauze having 125-micron (120 SWG) apertures to isolate the transducer from the main sample stream. It shall also have at least one flame arrestor in each of the inlet and outlet connections. But, in diffusion type instrument, the diffusion head should be such as to act as flame arrestor.

3.10 The dial glass shall be of toughened quality (*see* IS : 2148-1968*). In the event of leakage of glass, power to the illuminating bulb, if any, shall be cut off automatically.

4. CLASSIFICATION OF INSTRUMENTS

4.1 Instruments for the detection and measurement of methane gas are classified according to their operating range.

4.1.1 *Type I* — Methane indicators with scales reading up to 5 percent methane, by volume.

4.1.2 *Type II* — High concentration methane indicators with scales reading up to 100 percent methane, by volume.

5. ACCURACY OF THE INSTRUMENT

5.1 The permissible errors of the instruments are given in Table 1. At least 10 determinations shall be made at each percentage. Neither the average of 10 readings nor more than 2 readings for each percentage shall exceed the permissible error given in Table 1.

TABLE 1 PERMISSIBLE ERRORS

TYPE	DESIGNATION	PERMISSIBLE ERRORS	
		Range of Percent Methane	Error
(1)	(2)	(3)	(4)
I	Methane indicators	0–1	±0·1 percent methane
		Beyond 1 and up to 5	±10·0 percent of the true value
II	High concentration methane indicators and recorders	0—20	±2 percent methane
		21—100	±10 percent of the true value

NOTE — When methanometers are tested below 76 mm mercury or above 83·5 mm mercury, the permissible error may be up to ± 20 percent of the true value.

---

*Flameproof enclosures of electrical apparatus.

6. TESTS

6.1 Classification of Tests

6.1.1 *Type Test* — The following shall constitute type tests:

a) Physical examination (*see* **6.2**),
b) Physical tests (*see* **6.3**),
c) Tests for safety in explosive methane-air mixture (*see* **6.4**),
d) Performance tests (*see* **6.5**),
e) Test for intrinsically safe circuit (*see* IS : 9166-1979*), and
f) Additional tests, if required (*see* **6.6**).

These tests shall also be done for intrinsically safe circuit when rechargeable batteries are used.

6.1.2 *Acceptance Tests* — The following shall be carried out as acceptance tests:

a) Performance tests (*see* **6.5**), and
b) Additional tests, if required (*see* **6.6**).

6.1.3 *Routine Tests* — Physical examination and tests for accuracy in stagnant atmosphere (*see* **6.2** and **6.5.1.1**) shall be carried out as routine tests.

6.2 Physical Examination — Methanometers shall be examined for external finish, workmanship, mechanical zero setting, electrical zero setting and battery voltage indications.

6.3 Physical Tests

6.3.1 Drop Test — A dummy casing adequately loaded to represent the mass of the instrument when dropped from a height of 1·2 m on a concrete floor shall not get damaged to such an extent as to show cracks traversing the full thickness of the casing material or jeopardise the securing device of the instrument.

6.3.2 *Tests for the Adequacy of the Aspirating System* — After sampling 7·5 percent methane-air mixture by volume for Type I and 85 percent methane-air mixture for Type II, the methanometer shall indicate zero reading within 10 seconds by aspirating fresh air; when probe is used this should be within 20 seconds. For diffusion type head, the maximum time allowed shall be 60 seconds.

6.4 Test for Safety in Explosive Methane-Air Mixture — The methanometer shall be kept in a chamber containing 7·5 to 8·5 percent methane-air mixture and arrangement made for operating the methanometer in that atmosphere. Five tests shall be done. There shall be no ignition of external atmosphere in any test.

---

*Spark test apparatus for intrinsically-safe circuit.

6.5 Performance Tests

6.5.1 *Accuracy*

6.5.1.1 *Tests for accuracy in stagnant atmosphere* — Two methanometers shall be subjected to this test with several methane-air mixtures at intervals of about 0·5 percent methane covering the full range of scale. In case of Type II instruments, this interval may be of 5 percent methane. Differences between the instrument reading and the concentrations of methane of the standard sample shall not exceed the limits as stated in **5.1**.

6.5.2 *Test for Capacity of the Power Source* — The effect of changes in voltage of the supply battery on the zero and instrument reading shall be tested by feeding with air and 2 percent methane-air mixture (40 percent in the case of Type II instruments) respectively into the instruments to the point where the voltage indicator shows replacement or recharging of the battery or where the readings just fall below 10 percent of the true value, whichever is earlier. The number of readings shall be not less than 50 when a fresh (or a freshly charged) battery is employed to start with.

6.5.3 *Effects of Change in Pressure* — The instrument shall be placed in a chamber in which the pressure can be varied between $-7·5$ cm to $+7·5$ cm of mercury above atmospheric pressure in steps of 2·5 cm of mercury.

Four readings shall be taken, two readings with only air in the chamber, and two readings with 2 percent methane-air mixture in the chamber. The errors shall be within the permissible limits prescribed in **5.1**.

6.5.4 *Effect of Orientation of the Methanometer* — The effect of holding the instrument vertical, horizontal and at 45° shall be tested using 2 percent methane-air mixture. The test results shall comply with the accuracy limits stipulated in **5.1**.

6.5.5 *Effect of High Concentration of Methane*

6.5.5.1 *Effect of subsequent methane readings* — Tests shall be made using methane concentrations of about 8, 15, 30, 60 and 85 percent. The effect on subsequent readings in air and in a low methane concentration (about 2 percent) shall be noted for each high methane level.

For Type I instruments only, the zero-shift shall be not more than 0·2 percent of methane, and the error should not fall by more than 20 percent of the true values.

6.6 Additional Tests — Further tests as deemed necessary may be carried out by the testing authority, considering the principle of operation, the construction and the method of use of the instrument.

7. SAMPLING

7.1 Number of Samples and Criteria for Acceptance

7.1.1 *Type Test*

7.1.1.1 *Number of samples* — Two samples of methanometers complete with all the accessories shall be submitted for testing together with the instruction manual and blueprints in triplicate indicating the principal dimensions, layout of the component parts in the assembly, material of the casing as well as of the external components and schematic electrical circuit diagram complete with the specifications of the circuit elements.

7.1.1.2 *Criteria for acceptance* — The testing authority shall issue a certificate, if the methanometers are found to comply with the requirements of type tests. In case of failure in any one type test, the testing authority may, at its discretion, call for fresh samples not exceeding twice the number of original samples and subject them to test(s) in which the failure occurred. If in repeat test(s) on sample, without any change, no failure occurs, the test(s) may be considered to be satisfactory.

NOTE — If the samples fail in **6.1.1**(c) or **6.1.1**(e), the causes of failure, specially with respect to design, should be investigated and corrective measures taken before accepting samples for repeat tests.

7.1.2 *Acceptance Tests*

7.1.2.1 *Number of samples* — The number shall be in the proportion of 3 : 100, but in no case less than 3 pieces.

7.1.2.2 *Criteria for acceptance* — All samples shall conform to **6.5** and **6.6**.

7.1.3 *Routine Tests*

7.1.3.1 *Number of samples* — Each piece shall be tested for physical examination (**6.2**). Two pieces from each batch of manufacture shall be tested for accuracy in stagnant atmosphere (**6.5.1.1**).

7.1.3.2 *Criteria for conformity* — All samples shall conform to **6.2** and **6.5.1.1**.

(*Continued from page* 2)

Members	*Representing*
Shri K. N. Bhattacharya	The Safety First Association of India (Bihar Branch), Jamshedpur
Shri N. K. Saran (*Alternate*)	
Shri N. C. Brahma	Indian Chemical Manufacturers' Association, Calcutta
Shri Charanjit Lal	Chief Controllerate of Explosives, Nagpur
Shri B. R. Dave (*Alternate*)	
Shri A. Das Gupta	Adigee Industries, Calcutta
Shri B. Das Gupta (*Alternate*)	
Shri Francis Leslie Vaz	Francis Leslie & Co, Bombay
Shri Heathcliff Vaz (*Alternate*)	
Dr A. K. Gupta	Central Mining Research Station (CSIR), Dhanbad
Shri P. R. Roy (*Alternate*)	
Shri P. P. Jain	Mines Service Corporation, Asansol
Shri A. P. Agarwala (*Alternate*)	
Joint Director of Mines Safety	Directorate General of Mines Safety, Dhanbad
Shri S. S. Mazumdar	Indian Oxygen Ltd, Calcutta
Shri K. C. Karmarkar (*Alternate*)	
Shri N. C. Mukherjee	National Safety Council, Bombay
Shri N. Raghavan (*Alternate*)	
Shri S. K. Mukherjee	Mines Safety Appliances Ltd, Calcutta
Shri M. Mishra (*Alternate*)	
Dr M. Pancholy	National Physical Laboratory (CSIR), New Delhi
Shri C. Pereira	Joseph Leslie & Co, Bombay
Shrimati C. Leslie Roy (*Alternate*)	
Shri S. G. Ranade	Directorate General of Ordnance Factories, Calcutta
Shri G. V. Shah	Safety Equipment Corporation, Bombay
Shri J. V. Shah (*Alternate*)	
Shri S. D. Shroff	Pradeep Safety Pvt Ltd, Bombay
Shri Lal Sajnani (*Alternate*)	
Shri D. K. Sirkar	Synthetics and Chemicals Ltd, Bareilly
Shri P. R. Surendranathan	Directorate General Factory Advice Service and Labour Institutes (Ministry of Labour), Bombay
Shri M. K. Malhotra (*Alternate*)	

Panel for Respiratory Protective Equipment, ISAC/S-2/P1

Convener	
Dr A. K. Ghosh	Central Mining Research Station (CSIR), Dhanbad

Members	
Shri R. N. Mukherjee (*Alternate* to Dr A. K. Ghosh)	
Shri P. Bhargava	Industrial Medical Engineer, New Delhi
Shri S. P. Bhargava (*Alternate*)	

(*Continued on page* 11)

(*Continued from page* 10)

Members	*Representing*
Shri D. M. Dhar	Durgapur Steel Plant, Durgapur
Shri Durgesh Chandra	Century Rayon, Kalyan
Shri Jayant Adhia (*Alternate*)	
Shri P. Goenka	Nanda Miller Co, Calcutta
Shri J. P. Goenka (*Alternate*)	
Shri Heathcliff Vaz	Francis Leslie & Co, Bombay
Shri Francis Vaz (*Alternate*)	
Shri P. P. Jain	Mine Service Corporation, Asansol
Shri A. P. Agarwala (*Alternate*)	
Joint Director of Mines Safety	Directorate General of Mines Safety, Dhanbad
Shri S. C. Kale	Directorate General Factory Adivce Service and Labour Institutes, Bombay
Shri M. K. Malhotra (*Alternate*)	
Shri S. K. Mukherjee	Mines Safety Appliances Ltd, Calcutta
Shri M. Mishra (*Alternate*)	
Shri C. Pereira	Joseph Leslie & Co, Bombay
Shri R. R. Ramodurai	Fertilizer Corporation of India, Planning & Development Division, Sindri
Shri H. C. Roy Chowdhry	Directorate General of Civil Aviation, New Delhi
Shri S. D. Shroff	Pradeep Packagers, Bombay
Shri Lal G. Sajnani (*Alternate*)	